EARTHQUAKE SAFETY
IN
WASHINGTON STATE

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Division of Geology and Earth Resources

WASHINGTON STATE
Military Department
Emergency Management Division

Policy Recommendations
2004

A Report to the Emergency Management Council

Washington State
Emergency Management Council
Seismic Safety Committee

December 2003

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Table of Contents

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In 1991, the Seismic Safety Advisory Committee issued a report, A Policy Plan for Improving Earthquake Safety in Washington. Many, but not all, of its recommendations have been implemented. The February 2001 Nisqually earthquake demonstrated that more needs to be done. New technologies have emerged that will enable great strides in preparing for and responding to earthquakes and their collateral natural hazards (landslides, liquefaction, tsunamis, volcanic eruptions, and fires). It is also clear that new strategies will need to be devised to implement the remainder of the 1991 plan. Failure to move forward will leave Washington vulnerable to avoidable loss of life, injuries, property damage, and economic disruption.

THE EARTHQUAKE THREAT MATRIX IN WASHINGTON

Intraplate or Benioff Zone Earthquakes

Intraplate or Benioff zone earthquakes occur in the subducting Juan de Fuca plate at depths of 25-100 km (Fig. 1). The largest of these recorded were the magnitude (M) 7.1 Olympia earthquake in 1949, the M6.5 Seattle-Tacoma earthquake in 1965, the M5.1 Satsop earthquake in 1999, and now the M6.8 Nisqually earthquake of 2001. Strong shaking during the 1949 Olympia earthquake lasted about 20 seconds; during the 2001 Nisqually earthquake, about 40 seconds. Since 1870, there have been six earthquakes in the Puget Sound basin with measured or estimated magnitudes of 6.0 or larger, making the quiescence from 1965 to 2001 one of the longest in the region's history.

As the Juan de Fuca plate subducts under the North America plate, earthquakes are caused by the abrupt release of slowly accumulated strain. Benioff zone ruptures usually produce no large aftershocks. These earthquakes are caused by mineral changes as the plate moves deeper into the mantle. Temperature and pressure increase, and the minerals making up the plate alter to denser forms that are more stable at the increased temperature and pressure. The plate shrinks and stresses build up that pull the plate apart.

For the February 28, 2001, Nisqually earthquake, the hypocenter, or point beneath the surface at which the rupture starts, was at 32 miles. The area of rupture was approximately 18 miles by 6 miles and slipped approximately three feet. The epicenter was just off the Nisqually delta in Puget Sound. The quake was felt as far north as Vancouver, British Columbia, as far south as Salem, Oregon, as far east as Spokane, Wash., and as far southeast as Salt Lake City, Utah. Most of the damage was sustained in the Olympia and Seattle areas.

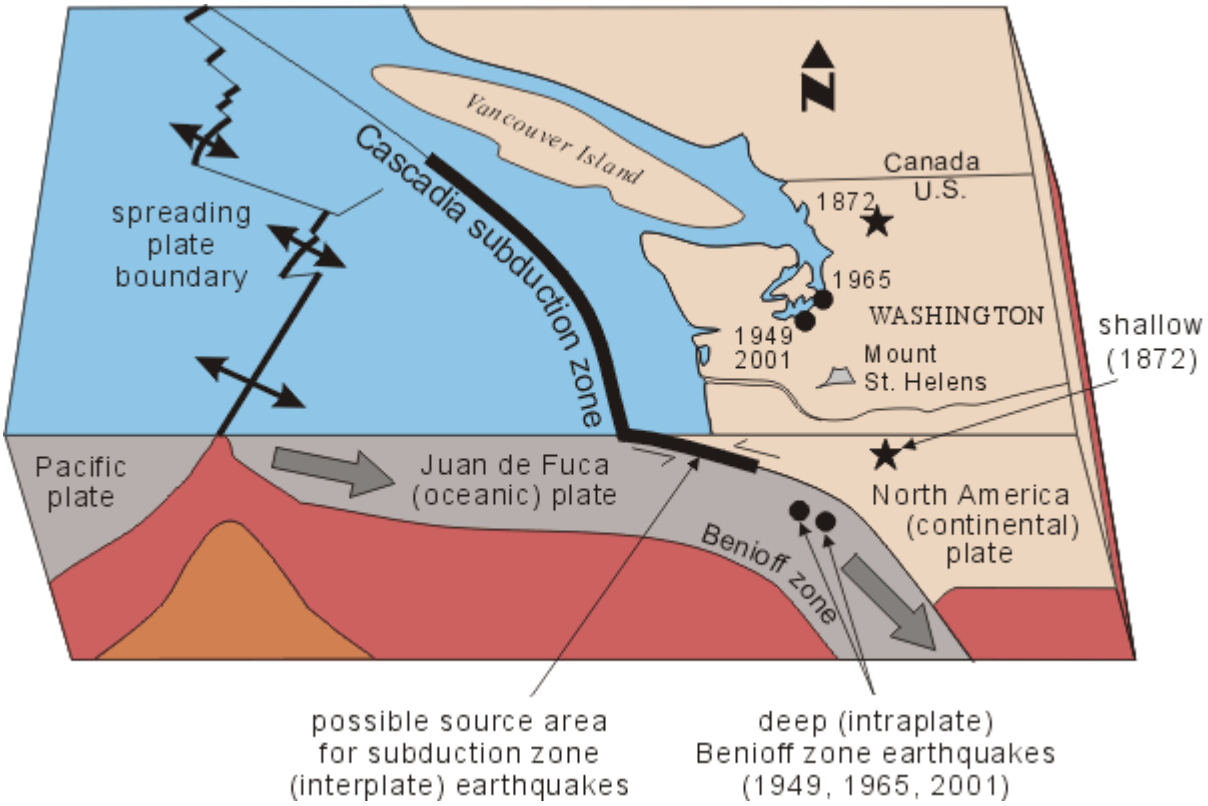

Figure 1. Sketch map showing tectonic setting of Washington and the three types, or source regions, of earthquakes that occur here.

Subduction Zone (Interplate) Earthquakes

Subduction zone (interplate) earthquakes occur along the interface between tectonic plates. Compelling evidence for great-magnitude earthquakes along the Cascadia subduction zone has recently been discovered. These earthquakes were evidently enormous (M8–9+) and recurred on average every 550 years. The recurrence interval, however, has apparently been irregular, as short as about 100 years and as long as about 1,100 years. The last of these great earthquakes struck Washington about 300 years ago. It triggered a tsunami that caused damage in Japan, including a shipwreck. Similar damage would be expected along the outer coast and as far inland as Bellingham.

Shallow Crustal Earthquakes

Shallow crustal earthquakes occur within about 30 km of the surface. Recent examples occurred near Bremerton in 1997, near Duvall in 1996, off Maury Island in 1995, near Deming in 1990, near North Bend in 1945, just north of Portland in 1962, and on the St. Helens seismic zone (a fault zone running north-northwest through Mount St. Helens) in 1981. All these earthquakes were about M5–5.5. In Oregon, historically a low-seismicity state, crustal earthquakes have recently occurred just south of Portland (M5.7) and in Klamath Falls (M6.0). The largest historic earthquake in Washington (estimated at M7.4), the North Cascades earthquake of 1872, is also thought to have been shallow. It may rank as Washington's most widely felt earthquake. Because of its remote location and the relatively small population in the region, though, damage was light.

Recent paleoseismology studies, aided by new technologies, such as LIDAR, a laser imaging technique that permits highly accurate topographic mapping through forest canopy (Fig. 2), have greatly enhanced our ability to locate and study active faults that were previously only inferred. This has resulted in an explosion of knowledge about the earthquake threat in Washington from shallow crustal earthquakes. We now know that there are at least seven active faults in the Puget Lowland that are capable of generating damaging earthquakes. Suspected faults are still being investigated and may lead to an assessment of even greater earthquake risk than is currently perceived. The figures below show examples of investigations of the Seattle fault in central Puget Sound and in the southern Olympics.

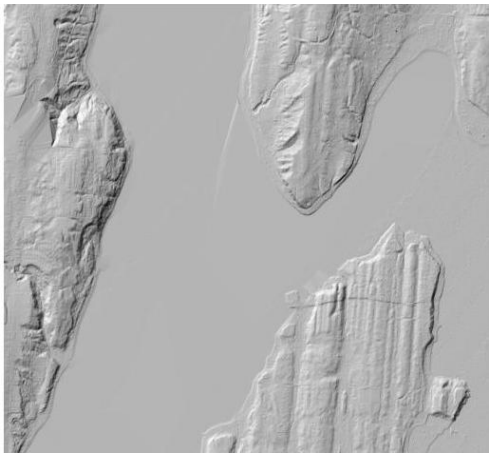

Figure 2. Lidar (light detection and ranging) image of the Port Orchard area the scarp that is shown in the trench in figure 3.

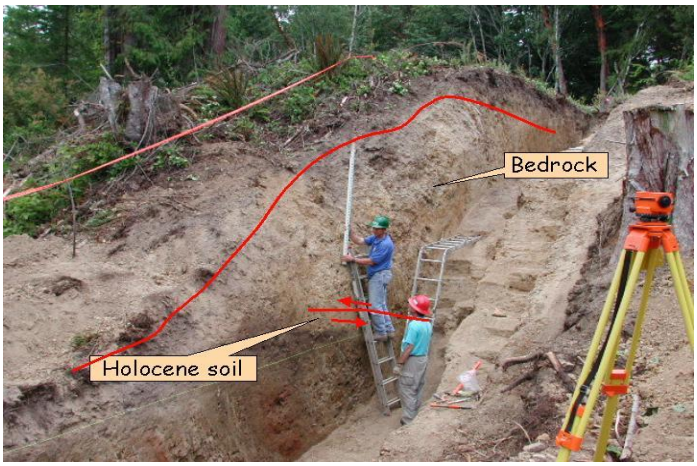

Figure 3. Trench across a fault in the Seattle fault zone near Port Orchard, showing a Holocene (less than about 12,000 year old) soil.

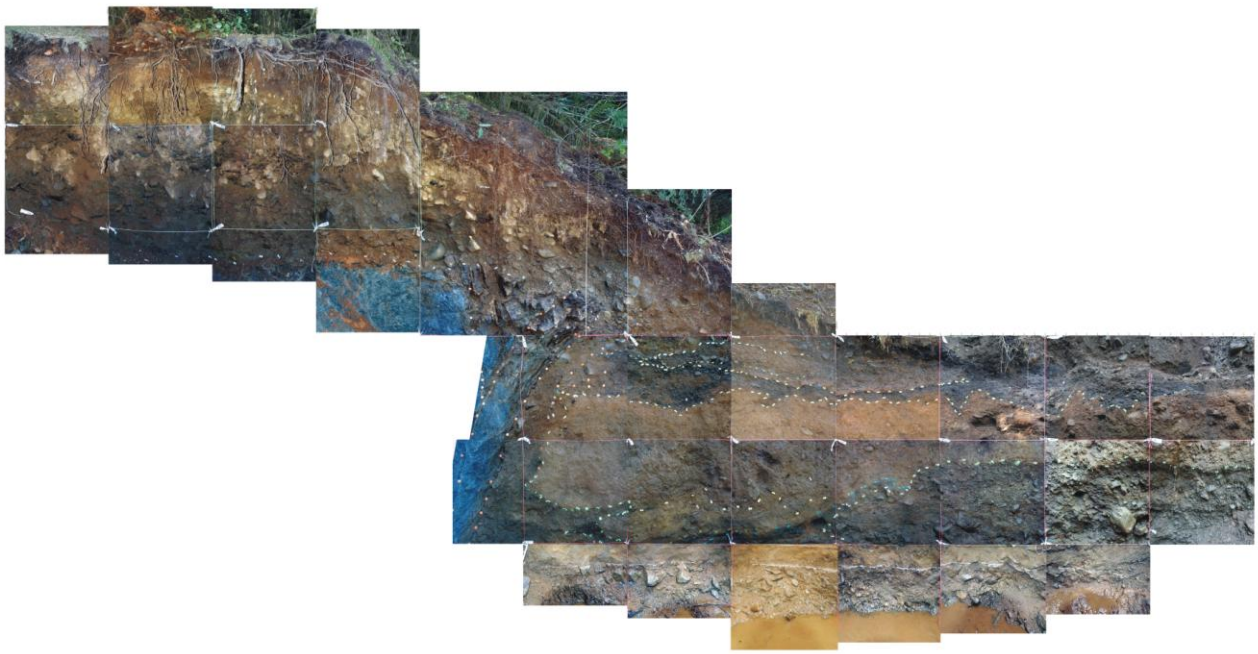

Figure 4. Trench across the Canyon River fault near Lake Wynoochee in the southern Olympics. The Crescent Formation basalt (bluish rock in the lower left) is thrust over a Holocene soil.

The SSC proposes these priority initiatives for reducing seismic risk in Washington State

The Seismic Safety Committee of the state Emergency Management Council developed these recommendations as updates to the 1991 report, a 1998 progress report, and the February 2002 Hazard Mitigation Strategy Update that was required by the Disaster Mitigation Act of 2000 in order to retain eligibility for federal disaster relief. Following some of the key recommendations is a discussion of benefits (+) and consequences of inaction (-). Additional recommendations and more detail on the initiatives listed here are included in the individual subcommittee reports included as appendices to this report. Following the approach in the 1991 report, the key recommendations for improving seismic safety policy in Washington State are listed in topical areas:

1. Establishing Seismic Safety Oversight
2. Emergency Management
3. Lifelines
4. Structures
5. Information, Technology and Communications

Recommendations that were included in the 1991 plan are followed by the section reference numbers from that plan in brackets. New recommendations are so noted in brackets.

1. Establishing Seismic Safety Oversight

- Provide support to the Seismic Safety Committee (SSC) for its primary goal of enhancement of life/safety, allowing it to have the staffing to perform its duties, goals, objectives, mandates and directives from the Emergency Management Council. [I.a]
  - \+ The SSC needs adequate support staff to compile life/safety needs, concerns and data, addressing the level of preparedness and allowing action plans to be forwarded to the Emergency Management Department (EMD) through the Emergency Management Council (EMC).
  - \+ Funding will allow the SSC to integrate information with other EMC working groups to provide optimal coordination of timely and factual reporting.
  - − Failure in providing staff to enhance the SSC's role in preparing and updating of action planning will hamper the EMC's ability to address the safety of residents of Washington during seismic activity.

2. Emergency Management

- Conduct a statewide review of emergency communications systems, and develop and implement review recommendations [II.a]
- Revise post-earthquake communications protocols among the Seismology Lab at the University of Washington, the Emergency Management Division's Emergency Operations Center at Camp Murray, the Division of Geology and Earth

Resources in Olympia, and the first-responders in the affected area(s) with emphasis on the rapid distribution of state-of-the-art information products and on improving the interaction of the media with the Emergency Operations Center. [New]

+ Post-earthquake communication among the listed entities is very poor, as was demonstrated during the Nisqually earthquake. Modern tools such as SHAKEMAP are not automatically distributed to the first-responder community. The media does not always contact the Emergency Operations Center for information. Some jurisdictions are proceeding with the establishment of independent post-event communications systems. The current situation significantly reduces the effectiveness of post-event response.

- Establish state oversight of local programs for volunteer recruitment, registrations, training, certification, management and evaluation [II.b]
- Require emergency management offices to fully meet the standards of Federal Emergency Alert System [II.a]

3. Lifelines

- Adopt a policy and fund a program to strengthen transportation lifelines using the following process [IV.a, IV.c IV.d]:
  - ▶ Establish criteria for defining lifelines through workshops
  - ▶ Set performance goals for lifelines through workshops
  - ▶ Identify and rank primary and secondary lifeline routes through workshops
  - ▶ Conduct vulnerability assessments of facilities on critical lifelines routes
  - ▶ Create an integrated state and local mitigation plan for lifeline transportation routes
  - ▶ Develop policy guidance and funding for a mitigation plan
  - ▶ Implement an integrated state and local mitigation plan
- Accelerate the current WSDOT seismic retrofit program [IV.b]
- Conduct training to ensure post-earthquake coordination among all agencies responsible for transportation [IV.h]
- Create and fund an applied research program on cost-effective techniques to mitigate ground failures around foundations [new]
- Develop utility lifeline performance objectives focusing on new facilities [IV.a]
- Conduct a series of workshops for major users, owners, regulators and public officials to improve the coordination of seismic mitigation/recovery efforts [IV.a]
- Require vulnerability assessments and development of mitigation plans [IV.e]
- Require public disclosure of the current state of expected utility system performance following an earthquake [new]

4. Structures

- Support the Building Code Council's recommendations to update and standardize the statewide building code as required. [new]
  - + Adopting this revised code will enable implementation of state-of-the-art of earthquake hazard analysis.
- Create an inventory of seismic upgrade needs of public school buildings and work with other state agencies on funding solutions to correct the deficiencies found. Many school buildings in Washington are older structures that were designed before seismic design requirements were fully developed. Some were designed for lesser lateral resistance than currently required, and they employ structural systems and material not permitted for present day seismic design. Some of these school buildings represent a substantial life safety and injury risk to children in this state, and they cause an element of economic risk and uncertainty to public agencies. This inventory would help determine which schools represent the greatest potential risks, and would establish where risks have been reduced through retrofit programs. The inventory would aid government agencies in making rational decisions regarding allocation of funds and repair and replacement of existing school facilities. [III.a]
- Support the updating and statewide training of the ATC20/ATC21 earthquake seismic building evaluation programs. Conduct workshops and training classes statewide to establish a pool of qualified state and private individuals to rapidly assess earthquake damage after an event. [new]

5. Information, Technology and Communications

- Develop a mechanism to share funding for the deployment and implementation of the Advanced National Seismic System (ANSS) to enhance the existing capability of the Pacific Northwest Seismic Network (PNSN) in both Washington and Oregon and integrate it with emergency management [III.f]
  - + The ANSS will consist of modern broadband seismometers that allow much more information about earthquakes (and their aftershocks), landslides, tsunamis, and volcanic hazards to be collected than is possible with presently installed instruments. This will enable the PNSN to quickly determine not only the size and location of an earthquake but also the type of fault rupture, the total energy release, and the strength and distribution of shaking levels at any sites affected by the earthquake. Such real-time earthquake information can be critical in saving lives and preserving property in the immediate aftermath of a disastrous earthquake. In addition, it will enable a new suite of products to facilitate disaster responses and will support implementation and improvement of the earthquake ShakeMap information product.
  - − Failure by the state to adequately fund implementation of ANSS will produce less federal interest and result in the deployment of fewer instruments, a decreased understanding of earthquake ground motions, and a decreased ability to correctly target areas of greatest need.

- Accelerate Department of Natural Resources geologic and hazard mapping in urban and urbanizing areas and statewide for both mitigation and land use planning (under GMA). [III.e]
  - + An understanding of the geologic factors in earthquake ground response and ground failure permits appropriate land use and engineering planning decisions in development.
  - + Communities evaluating local hazards to meet mitigation planning requirements need access to and interpretation of current best science available. State support is needed to restore and enhance DNR/Geology Division consultation capabilities to assist local hazard assessments.
  - − Failure to implement consistent statewide geologic hazards information renders many communities unable to make rational assignments of critical areas under the Growth Management Act and results in unwise development in geologically hazardous areas.
- Require the establishment of a permanent earthquake information clearinghouse function [new] including the establishment of a registry of technical professionals able to assist the state in assessing damage following an earthquake. The registry would establish procedures to guarantee professionals access to areas damaged by earthquakes [II.b]
  - + This will enable coordinated responses by volunteer professionals in diverse fields to optimize collection and sharing of time-sensitive data.
  - − The lack of a clearinghouse in past events resulted in confusion and loss of data useful for mitigation of subsequent events.
- Develop a mechanism to route geotechnical information to a centralized database at DNR/Geology Division, i.e., require contractors to furnish a copy of borehole data produced for public agencies to a centralized location.
  - + This will facilitate appropriate planning for mitigation strategies and land-use planning as well as other geotechnical and hydrologic uses.
  - − Valuable data necessary for appropriate land-use planning are lost because there is currently no data repository and local jurisdictions commonly do not save these data or make them readily available to other users.
- Adopt the Applied Technology Council (ATC-54) guidelines as a tool for using strong motion data for planning and post-earthquake evaluation [new]

Appendices

Subcommittee reports, which were submitted in May 2002, are reproduced here as received. The recommendations of the SSC are updated to reflect subsequent events, such as legislative passage of a bill to adopt more current building codes.

Emergency Management Subcommittee

Washington State Emergency Management Council

Seismic Safety Committee

II.a Conduct a statewide review of emergency communications systems, and implement review recommendations.

Comment: Communications challenges exist at the state and local levels. Many new technologies are now being used commercially that can be adapted for government use and for emergency response, e.g. wireless, satellite, Internet. Communications need to be two-way and promote inter-jurisdictional and inter-discipline functionality. The Emergency Alert System needs to be fully implemented in Washington State as part of this communications system.

Discussion:

Statewide Radio Interoperability:

While many improvements in emergency communications systems have been made and many of the recommendations from the original document have been implemented, communications are such a vital part of emergency/disaster response that existing systems and new technologies should be continually evaluated. Natural and technological emergencies can destroy or stress emergency communications systems beyond their design capacity. The ability to communicate during an emergency response is essential to allocating resources and protecting life and property. Technological advancements in communications equipment, the development of new means of communications and changes in Federal Communications Commission (FCC) rules require continual review of emergency communications capabilities to verify that the existing systems comply with FCC rules and that, new systems continue to meet the demands of emergency response communications.

Washington State should continually evaluate emergency communications systems identifying gaps and weaknesses and developing strategies for overcoming those gaps and weaknesses using existing, new and emerging technologies. Compatible communications systems are critical in situations requiring mutual aid from neighboring jurisdictions or disaster assistance from more distant organizations. The migration of jurisdictions from VHF/UHF communications systems to 800 MHz systems, the narrow-banding of VHF systems, and new technologies have increased the likelihood of system conflicts during mutual aide and emergency/disaster responses

There are several levels of communications required in emergency situations:

- Between city and county emergency operations centers (EOC's) and the Washington State EOC
- Between the Washington State EOC and state agency control centers
- Between state agency control centers and state agency responders
- Between city and county EOC's and local agency control centers

- Between local agency control centers and local responders
- Between responders in the field from a hodgepodge of agencies and jurisdictions
- Between emergency decision makers and the public

Washington State has established a State Interoperability Executive Committee (SIEC) that has the responsibility to recommend solutions for the radio communications problems faced by all public entities. This committee is composed of representatives from the Governor's office, Department of Corrections, Department of Health, Department of Information Services, Department of Natural Resources, Emergency Management Division, King County, Washington State Association of Fire Chiefs, Washington Association of Sheriffs and Police Chiefs, Washington State Department of Transportation, Washington State Patrol, and Office of Financial Management. The development of possible solutions for each of the identified levels of emergency communications is currently being explored by a SIEC technical sub-committee that is hosted by the Department of Information Services (DIS) and has representatives from WSP, WSDOT, DNR, Parks and EMD. ***This committee should be expanded to include representatives from County and City governments.*** The coordination, systems development and engineering required to address the problems of interoperability in Washington State ***dictates that a state office be established to oversee and manage solutions.*** A state office would provide a central focus point for all interested parties, State, Local and Federal, that wish to participate. The logical place for this office would be within the Department of Information Services since it is responsible for maintaining the statewide intergovernmental data network. Since voice (radio) and data technologies are converging due to recent developments in Voice over Internet Protocol (VoIP), DIS has the best technical capabilities of existing state agencies to coordinate statewide interoperability solutions.

This new ***State Interoperability Office (SIO)*** would be responsible for assisting local jurisdictions establish communications systems that meet their needs for day-to-day operations and emergency/disaster communications. This office would set standards on all interoperability requirements and work with vendors to implement selected solutions. It would also have the responsibility to manage those systems after implementation.

Specifically, the SIO would be tasked to develop or provide communications enhancements of the following:

1. Development of regional and statewide communications systems to provide interoperability. This could range from the simple sharing of communication interoperability of frequencies to installing a complete statewide system.
2. Repository and coordinating office for the establishment of mutual aid agreements and standard operating procedures not only between local agencies, but also between state and federal agencies. Agreements will need to address the proprietary ownership issues inherent with existing systems.
3. Promote the implementation of the Uniform Incident Command System to enhance communications in emergency response situations.

4. Evaluate communications capabilities during mass casualty and disaster response training drills to identify existing capabilities and potential shortfalls.
5. Maintain a database of state and local communications capabilities identifying communications tools and their capabilities.
6. Ensure the state adheres to common technology standards in the design, procurement and implementation of future public safety communications systems.

Other emergency communications alternatives should also be addressed, such as, Amateur radio (Amateur Radio Emergency Service (ARES) or Radio Amateur Civil Emergency Service (RACES).

Emergency Alert System:

Washington State has assumed a proactive role in assistance to local jurisdictions in the development of the Emergency Alert System (EAS). The state purchased and distributed 51 EAS encoders for local use. The State Emergency Communications Committee for EAS has developed a statewide plan for EAS that has made the Washington EAS one of the best in the nation. There are currently 17 Local Area Communications Committees to address local concerns, agreements and develop local plans. However, the deployment of EAS in the state is not fully completed at the local level and is only progressing in those counties that want the local capability to activate the EAS. Washington is a home rule state and some jurisdictions have opted to not install EAS. Those jurisdictions normally do not have the resources to install EAS***. State funding of EAS at the local level would greatly expand the use of EAS.***

The Emergency Alert System has the potential to be activated twice in the same region for a single event. This could be due to more than one jurisdiction from the same operational area activating the EAS during an emergency or disaster. Neighboring jurisdictions must reach agreement concerning the coordinated activation of the EAS long before the emergency occurs in order to ensure that appropriate protective action information will reach the effected population in a timely fashion. Failure of neighboring jurisdictions to reach an agreement concerning the timing of EAS activations, content of EAS messages and follow-up information and press releases, prerecording EAS messages and providing for back-up activation of the system in the event of equipment failure will needlessly endanger lives and property. The state must take the lead in educating public officials in the critical responsibilities they have in using the Emergency Alert System to protect lives and property and allowing emergency decision makers to provide timely, critical information to the public during emergencies and disasters.

IIb: "Establish state oversight of local programs for volunteer recruitment, registration, training, certification, management and evaluation."

Locally-affiliated volunteer recruitment and training, including but not exclusively programs developed under FEMA's Community Emergency Response Team (CERT) umbrella, are hosted by a diverse spectrum of agencies. City and county governments, fire districts, police departments, businesses, churches, schools, utility districts, neighborhoods and military bases have sponsored emergency team training and continue to build their volunteer corps. Some of these volunteer groups are specifically identified as disaster response teams, with training paid for by the parent agency. Most,

however, are individual citizens who want to be better prepared for responding to emergencies in their own neighborhoods.

The success of these volunteer programs where they are actively supported, and the diversity of the program's sponsors, are a powerful endorsement that the private citizens of Washington State have listened to our oft-repeated messages about hazards and vulnerabilities. Many people begin volunteer training with the sole purpose of becoming better prepared at home, and get involved as response team members because they develop a sense of community during their classes.

Unfortunately, the very diversity of volunteer programs' sponsorship has created substantial coordination and management problems at the local level. County or city emergency management agencies can not afford the staffing to provide for full-time supervision of volunteers, including certification of programs, classes and instructors, continuing education and training for the volunteers, and maintenance of an ever-expanding database of volunteer personnel. Few local jurisdictions have the ability to seek federal funding support for volunteer programs, and the state has no direct funds available for this purpose.

Washington State Emergency Management Division already has the organizational structure in place to register, certify and track volunteers (search and rescue program). Training in emergency management skills is also currently offered at the state level, albeit mostly classroom and organizational in nature. A suggested solution to the volunteer management problem is to expand EMD's volunteer registry and certification to include volunteers trained under specific programs (CERT, primarily) that have well-supported curricula. Additional needs for continuing education, particularly in hands-on responder skills, could be coordinated through EMD's PET division with local support and input.

II.d. "Public education of disaster hazards and appropriate protective actions needs to be provided to communities on a recurring basis."

The Washington State Department of Emergency Management developed a disaster preparedness program and April has been designated as Disaster Preparedness Month. Additionally, September has been designated NOAA Weather Radio Awareness Month ~ for all hazards. Brochures and pamphlets have been developed for various aspects of personal preparedness and earthquake information. The "All Hazard Safety Workshop for Schools" is offered to local jurisdictions on an as requested basis. A new "Public Education Instructional Skills Program" is offered to the local jurisdictions upon request, the first delivery of this course is scheduled for June, 2002. A few videos and some school curriculum elements have been developed for schools. After the Nisqually earthquake FEMA developed a chimney and business safety poster.

State Emergency Management has offered many ATC 20 and ATC 21 courses throughout the region. It is recommended that this course continue to be offered throughout the State.

As technology advances and the use of computers and multimedia systems are more available, it is recommended that we look at developing additional delivery methods for emergency preparedness information and materials. Some suggestions are as follows:

- Develop additional courses/resource material to address needs of:
    - Businesses
    - Adults
    - Special needs populations.
- Develop alternate distant learning delivery methods:
    - CD ROM
    - Web Based Curriculum and education opportunities
    - Video
    - Intranet/Internet~ For maximizing the availability of seismic safety and preparedness publications
    - Interactive Learning ~ video conferencing, computer based learning
- Partner with others to provide additional education opportunities.
    - Businesses
    - Care providers
    - Hospitals
    - Special populations and people with disabilities

It recommended that state and local entities continue and increase the support of activities of various Agencies in training and education.

II.e Washington State Emergency Management Division coordinates and conducts recurring earthquake and other exercises for state agencies and local jurisdictions.

Comment: Washington State Emergency Management Division has made a substantial effort to provide standardized emergency/disaster planning guidelines for local jurisdictions. It is recommended that this effort evolve into assisting state agencies and local jurisdictions validate their emergency/disaster plans through meaningful emergency/disaster exercises.

Discussion:

The Washington State Emergency Management Division has made a substantial effort to provide local jurisdictions with standardized emergency/disaster planning guidelines within the context of encouraging local jurisdictions to prepare comprehensive emergency management plans and to submit them for review. As this process approaches completion, it is time to begin moving forward to the next step of assisting local jurisdictions and state agencies validate their comprehensive emergency management plans through meaningful emergency/disaster drills and exercises. Civil liability is more likely to accrue following an emergency or disaster if existing plans and

procedures were not followed or were not periodically validated through drills and exercises.

The object of creating emergency management plans is to document, to the extent possible, the command structure, priorities, policies, legal authorities and procedures that will be used during an emergency/disaster response. When detailed planning guidelines are provided, emergency management plans are often created by editing the planning guide to insert names and places from the local jurisdiction instead of creating the plan by getting the appropriate public officials together to work through and talk out how the jurisdiction will respond to emergencies or disasters. This often results in a cookie cutter plan that may satisfy the guidelines, but does not reflect how the jurisdiction would actually respond.

Drills and exercises can be used to validate emergency operations plans by using realistic scenarios, documenting the actual responses and then comparing the actual responses to the plans. If the drill responses are not conducted according to existing plans and procedures the conflicts can be resolved through additional training or plan revisions. Drills and exercises also encourage the responders to develop the relationships and trust essential to effective response in real situations.

After emergency operations plans of neighboring jurisdictions have been validated through meaningful exercises, the state should coordinate regional exercises to determine the adequacy of local plans to response to regional disasters such as seismic events. These regional exercises will help to validate the Washington State Comprehensive Emergency Management Plan and identify additional resources needed for response to a widespread seismic event.

II.f. "Develop partnerships to facilitate continuity of operations."

Comment: Historically, Emergency Management has focused on life and health safety issues related to disaster response. There needs to be a move towards focusing not only on response but long term recovery.

Discussion:

New research strongly suggests that business more often than not can neither respond nor recover from disasters in isolation. Businesses located in hazard resistant structures may still fail following a significant event if their business plans are not sufficiently flexible to adapt to the changed post-disaster situation. Like government, when businesses are adversely affected by a disaster they need to be able to identify resources quickly, if they are to recover.

Government needs to involve the business community with all phases of emergency management. Relationship alternatives need to be explored, partnerships formed, and protocols for resource disbursement developed.

A new role government/business relationship is emerging within the emergency management community. Emergency Managers are increasingly involving private economic interests in all phases of emergency management. Similarly, businesses have expressed the need for assistance in preparing for and recovering from disasters.

This evolution is demonstrated by the numerous project impact government/business partnerships that have been created, and an increasing number of communities have wrapped business interests into their EOC operation. The State of Washington has two business members on their Emergency Management Council.

Other points for consideration:

- There needs to be an increased focus on recovery planning at all levels
- The only way to survive a disaster is to ensure the survivability of the economy.
- It is important to create an environment for economic recovery. This is a concern of government and community leaders.
- Few businesses appear to have partnerships and mutual aid arrangements.
- There is often an unwilling ness by businesses to expose vulnerabilities.
- Only a few government EOCs have businesses elements integrated into their operations
- Few if any business EOCs include government representation or representation for other business concerns

Recommendations:

In order to increase the transfer of best practices and science there must be commitment to foster and encourage public/private partnerships by entities within the state and region.

There must be an emphasis in governmental participation in organizations, groups or committees to assist with addressing special needs of Agencies, Departments or Industry to deal with the seismic hazards and addressing development of plans, mitigation efforts or recovery issues related to seismic and tsunami hazards.

Emergency Management needs to work with business and civic organizations to develop long-term strategies for economic survivability and long-term recovery post disaster.

Lifelines Subcommittee

Washington State Emergency Management Council

Seismic Safety Committee

Strengthening Transportation Lifelines

The following process is recommended to strengthen transportation lifelines that include the highway system, the ferry systems, and airports. Railroads are explicitly excluded because of lack of jurisdictional control by the State. The process should be facilitated by the State as an integrated effort of Federal, State, local governments, and local agencies in consultation with major users of the transportation network. The process should be done sequentially (1-7) in accordance with the importance of lifelines with respect to both life safety and economic viability.

1. Establish criteria for defining lifelines. (workshops)
2. Set performance goals for lifelines. (workshops)
3. Identification and prioritization of critical primary and secondary lifeline routes. (workshops)
4. Vulnerability assessment of facilities on critical lifeline routes.
5. Creation of integrated State and Local mitigation plan of seismically resistant transportation lifeline routes.
6. Policy guidance and funding from legislative and executive branches of public agencies.
7. Implementation of the integrated State and Local mitigation plan.

The following should be done concurrent with the above process:

1. Creation of permanent information clearing house and registry of professional/technical experts.
2. Training to enable effective post-event coordination among Federal, State and local agencies responsible for transportation facilities.
3. The current WSDOT seismic retrofit program should be accelerated to enable completion in 10 years.
4. Create and fund an applied research program focused on cost effective techniques to mitigate ground failures.

List of Possible Action Items: Lifelines

The following projects are recommended to be facilitated by the State as an integrated earthquake hazard mitigation effort for Lifeline owners and operators.

LIFELINE POLICIES

The State should implement the following requirements:

1. Develop (in workshops) and adopt lifeline performance objectives. Focus on design standards for new facilities that will result in achieving system performance objectives in the long term.
2. Require Emergency Response and Recovery Plans (similar to SEMS, State of California) for both Public and Private sector lifelines.
3. Require vulnerability assessments and resulting development of mitigation plans (per FEMA hazard mitigation requirements). Required for the Public sector lifelines and encouraged for the Private sector lifelines.
4. Require disclosure of the current state of expected system performance applicable to Public sector lifelines that is based on standardized probabilistic/scenario earthquake event.
5. Establish a long term SSC structure.
6. Develop and implement a statewide policy for lifeline owner/operator essential personnel access to critical lifeline facilities during post-earthquake events.

LIFELINE WORKSHOPS

The State of Washington shall sponsor workshops for major users, operators, owners, regulators and public officials to improve the coordination of seismic mitigation and recovery efforts for each type of lifeline (power, water and waste water, telecommunication, gas and liquid fuels, marine ports, rail roads). The goals of each workshop would vary according to the needs and requirements of the lifeline system, but would include the following:

- Exchange statewide information on the operational/reliability of lifeline systems
- Lifeline design, emergency response and recovery technology exchange
- Identify lifeline systems that are critical to the safety of the public and the economic health of the State of Washington
    1. Identify Critical Lifeline components
    2. Identify Critical Lifeline interconnections
- Identify Lifeline interdependence
- Identify lifeline design performance levels
    1. Performance Objectives
    2. Return Period, probability of exceedance
    3. Acceleration Level
    4. Duration
    5. Distributed Systems

- Facilitate interagency coordination for mitigation and recovery efforts
    1. Mutual Assistance Programs
    2. Emergency Stocking Inventory
    3. Liaison with local EOC's
- Exchange strategies for overcoming financial and technical obstacles to improving mitigation and recovery efforts
- Identify common needs for training and education of users and operators of lifelines systems
- Identify future issues and concerns to be addressed

PUBLIC TRAINING

Provide information on operation and expected reliability of lifeline systems to local officials (focus on fuel pipelines and rail systems).

FUNDING AND STAFF

Provide funding and staff support for coordination of lifeline workshops

ATC 20-21 and Volunteer Liability

Study of recent earthquake response requirements point to the need for a coordinated region-wide effort to address the need for the post earthquake safety assessment of buildings. In aftermath of the January 17, 1994, Northridge 6.7 Mw earthquake, City of Los Angeles was receiving about 200-300 calls per hour for building assessments, immediately after the event.

In the two weeks following the event City of Los Angeles requested and deployed over 100 to 300 emergency building evaluation respondent volunteers and paid inspectors per day (Richard A. Ranous, *Postearthquake Safety Assessment: Deploying Qualified Personnel following the Northridge Earthquake,* Building Standards*,* May/June 1995). A total of over 114,000 buildings were inspected and re-inspected with about 3,000 red tagged and 12,000 yellow-tagged buildings identified.

Deployment of such a large inspection team requires a coordinated effort by the requesting agency to ensure that qualified and trained inspectors are sent to the field. The training required must be provided prior to such an event. My experience as a volunteer inspector in Northridge was that the City of Los Angeles in order to meet the demand was conducting the required Applied Technology Council (ATC) – Postearthquake Safety Evaluation of Buildings (www.atcouncil.org), course which would normally take 4 to 5 hours in 20 minute sessions.

In preparing for events such as the Northridge or Nisqually earthquakes, a regional effort to train, register, and deploy volunteers and paid inspectors must be developed. In addition to the normal emergency response training (CPR, First Aid, Light Search & Rescue), the following courses are essential:

a. Rapid Visual Screening of Buildings for Potential Seismic Hazards, ATC-21, based on the Federal Emergency Management Agency (FEMA) (www.fema.org) document 154, published July 1988 and converted to a teaching course by ATC, includes a methodology for rapid evaluation of a number of buildings using a scoring system, by evaluating building lateral structural system and other important factors.

b. Postearthquake Safety Evaluation of Buildings, ATC-20, document and course developed by Applied Technology Council in 1989, provides a methodology for evaluation and tagging of buildings following an earthquake or any event causing structural damages and instability problems. Buildings are evaluated using a Green (Inspected), Yellow (Limited Entry), or Red (Unsafe) tagging system.

Currently, in the State of Washington there is no unified coordinated effort to train and register volunteers and inspectors. Many municipalities through either their emergency management office or fire department try to conduct ATC-20 & 21 classes from time to

time and some jurisdictions even make an attempt at registering their trained inspectors. However, these activities are on ad hoc basis and are not coordinated. State of Washington Emergency Management Division has been conducting ATC 20 & 21 courses in major cities around the state to increase the number of train inspectors. King County had also been involved in providing training classes and registering the trained inspectors, however due to shortage of funding their training activities have been reduced or stopped.

In addition to Government agencies involved in the training and response activities, professional organizations have also been trying to provide training programs. American Institute of Architect's (AIA) Disaster Preparedness and Response Committee (DP&R), has been involved with training local architects, engineers, contractors, facilities management and maintenance professionals in the private and public agencies, by providing the ATC 20 & 21 courses. Structural Engineers Association of Washington's (SEAW) Disaster Response Sub-Committee has also been involved in providing training programs for it's membership and local communities.

A unified and managed approach to the training and registration of the volunteer and paid inspectors at the State level must be developed to address the needs of the Washington communities following large seismic or weather related building damage. Examples of such events have occurred repeatedly in the recent Washington State history (Winter Storm 1996 and Nisqually Earthquake 2001).

III.d Background on the Financial Incentives issue:

The Policy Plan for Improving Earthquake Safety in Washington, 1991, recommends, among other ideas, that the Seismic Safety Committee "develop financial incentive programs to assist with seismic upgrade projects." The document does not specify structural mitigation only.

Some ideas previously suggested involved reduced insurance rates for retrofitted structures and property tax rebates or reductions for costs of retrofitting. Project Impact in Seattle did have a successful program that involved funds from a FEMA grant.

In considering the possibilities of financial incentives in the current tight property insurance market, and current budget shortfalls, it seems that any proposals should conform to the following criteria:

- Should have as minimal an impact as possible on state and local budgets.
- Should be as easy as possible to apply and administer.
- Should be as effective as possible for the effort expended.
- Be able to be communicated to the widest possible at-risk population.

In addition, any suggestions should first determine which activities have the largest positive impact and target those.

Some issues for discussion – What is the percent of possible damage, residential v. commercial? Residential could be the largest property impact but business interruption could be the largest economic impact. Which one to target?

Mandating earthquake insurance coverage rates, either through mortgage companies or property assessment, would cause insurance companies to either overextend their ability to respond to claims or to charge inadequate rates. If rates and capacity were adequate, how would the increased amounts of premiums charged impact the public's ability to purchase and maintain property?

In an earthquake, who pays? Given the large deductibles and minimum deductible amounts, the policyholder pays the first (many) dollars in a loss. FEMA grants to individuals and public entities provide some relief for the first dollar payments. Therefore, mitigation would benefit FEMA in reduced grants for damages. Could we consider a federal tax credit for mitigation activities, since reduced payments benefit federal funds?

Other programs suggested are:

- Subsidized, reduced or free permits for specific mitigation work.
- Subsidized or donated inspections to certify the work was done properly.
- Reduced cost of materials (like the low flow toilet program recently in Thurston County).
- Final inspection acceptable to qualify for the tax credit. (Federal or State)
- Have a system in place to help property owners through the process.

There are always lots of reasons why ideas won't work. Right now we're looking for any suggestions that would be feasible enough to suggest to the committee to explore further.

STRENGTHING BUILDINGS

OBJECTIVE: Assess Seismic Vulnerability of School Facilities. (Additionally, the committee is doing Fire/Police, and Hospitals)

Who involved: Schools: Currently have a request in to Craig Apperson at OSPI for replacement to Jim Cooper who moved out of state. Fire/Police: Jim Walkowski. Hospitals: Fred Savaglio and Linda Noson.

OBJECTIVE: Develop Building Code Amendments Requiring Seismic Strengthening During Remodel.

Who involved: Tim Nogler.

OBJECTIVE: Review the Current Uniform Building Code Seismic Zone 3 Boundaries.

Who involved: Tim Nogler.

OBJECTIVE: Develop Financial Incentive Programs to Assist with Seismic Upgrade Projects.

Who involved: Joan Scofield, Bob Freitag,

OBJECTIVE: Support and Coordinate the Geological Mapping of Sensitive Areas.

Who involved: Craig Weaver, Tim Walsh.

OBJECTIVE: Support the Implementation of a Strong Motion Instrumentation Program.

Who involved: Craig Weaver, Tim Walsh, and Steve Malone.

Information, Technology and Communications Subcommittee

Washington State Emergency Management Council

Seismic Safety Committee

Technology

1. Support Strong Motion Monitoring Network – Support the existing UW program to monitor earthquakes and collect recordings of ground motion in urban areas using specialized strong motion and broadband seismographs at sites having a variety of geologic conditions.
2. Install Seismograph Detectors on Structures – Require the instrumentation of new and some existing man-made structures so we can learn how they respond during earthquakes. Such instruments can help detect whether, during an earthquake, the structures suffer irreparable damage that may not be obvious to the eye.

Information

1. Expand Response Planning Information Products and Training – Further develop earthquake hazard information products and training for state and local government personnel involved in response planning.
2. Streamline Rapid Delivery of Earthquake Information – Support the implementation and improvement of *ShakeMap* (and other products) including the speed at which it is produced, its accuracy, and its resolution.
3. Create State Subsurface Geologic Database – Develop a statewide database of surface and subsurface geologic site conditions that can be used to improve estimates of earthquake damage in future earthquakes.
4. Adopt New ATC-54 Guidelines – Support the use of the Applied Technology Council and California Geological Survey ATC-54 report “Guidelines for Using Strong-Motion Data for Postearthquake Response and Postearthquake Structural Evaluation” as a tool for planning and earthquake mitigation.
5. Develop Information Clearinghouse – Study the need for a state-based earthquake information clearinghouse before and after earthquakes. How should an information clearinghouse be managed right after a major earthquake? Use the FEMA funded clearinghouse set up after the 2001 magnitude 6.8 Nisqually earthquake as a starting model.

Communications

There is a basic need for non-interruptible communications during a major earthquake.

1. Improve State Emergency Alert System – Require state emergency management offices to fully meet standards of the Federal Emergency Alert System (EAS) under the direction of the State Emergency Communications Committee (SECC).

2. Integrate State and Local Emergency Response – Encourage the further development of county and local emergency communications committees and assist them to become fully active in the Emergency Alert System via training and improved communications equipment. One way to do this is via the NOAA Emergency Managers Information Network (EMWIN). EMWIN is a suite of data access methods including radio, Internet, and satellite, which make available a live stream of critical emergency information.
3. Utilize NOAA Alert Capability – Encourage and assist NOAA in providing full NOAA Weather Radio coverage and training to all of Washington State for the purpose of providing earthquake and tsunami alerts.
4. Evaluate Emergency Communication Scenarios – Evaluate how voice communications, automated email, and Web-based earthquake data products can be delivered rapidly and reliably even during a major event when the demand for communications is high. Require agencies that deliver such information to employ technology that ensures rapid delivery under all conditions.

Committee Membership

Seismic Safety Committee

Name	Organization
Committee Chair	
Doug Sutherland	Department of Natural Resources – Commissioner of Public Lands
Committee Co-Chairs	
Ron Teissere	Department of Natural Resources – State Geologist
Glen Woodbury	Washington State Emergency Management Division - Director
Committee Members	
Craig Apperson	Office of the Superintendent of Public Instruction
Sophia Byrd	Washington State Association of Counties
George Crawford	Washington State Emergency Management Division - Technical Advisor
Stan Finkelstein	Association of Washington Cities
Bob Freitag	Cascadia Region Earthquake Workgroup
Linda Groce	Washington State Hospital Association
Eric Holdeman	Washington State Emergency Management Association
Chris Jonientz-Trisler	Federal Emergency Management Agency Region X
Ken Korshaven	EMC Representative-Building Officials
Jerald Lavassar	Department of Ecology
Dan Mageau, P.E.	American Society of Civil Engineers
Harold Mofjeld	NOAA/PMEL
Tim Nogler	Office of Community Services-Growth Management/Building Code Council

Name	Organization
Tony Qamar	University of Washington-State Seismologist
Joan Scofield	Office of Insurance Commissioner
Peggi Shapiro	Washington Association of Hospitals
Terry Simmonds	Department of Transportation
Greg Staley	Department of Health
Stu Trefry	Washington PUD District Association
Jim Vane	Department of Information Services
Greg Varney	Structural Engineers Association of Washington
Tim Walsh	Washington State Department of Natural Resources - Technical Advisor
Craig Weaver	USGS
Mary Corso	Washington State Patrol

Emergency Management Subcommittee

Name	Organization
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Karin Frinell-Hanrahan	Grays Harbor Department of Emergency Management
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Bob Freitag	Cascadia Regional Earthquake Workgroup (CREW)
Brian Calvert	Benton County Emergency Services
Dave Byrnes	Spokane Department of Emergency Management
Dave Nelson	Washington State Emergency Management
George Crawford	Washington State Emergency Management
Jerry Gardner	SAFECO Corporate Risk Management
Mike DeCapua	Police Chief, Quinault Indian Nation
Mike McCallister	Snohomish County DEM Coordinator

Structures Subcommittee

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Tim Nogler	Washington State Building Code Council
Linda Noson	Linda Noson Associates
Joan Scofield	Office of Insurance Commissioner
Fred Savaglio	Washington State Hospital Association
Jim Walkowski	Washington State Fire Chief Association
Craig Weaver	Lifelines Subcommittee Representative
Behrooz (Ben) Emam	University of Washington
Charles Roeder	University of Washington
Joe Butler	Thurston County
George Crawford	Washington State Emergency Management Division
Dave Nelson	Washington State Emergency Management Division

Lifelines Subcommittee

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Roger Flint	Spokane Public Utilities
Bob Shulock	Jacobs Sverdrup
Jim Marshall	Covington Water District
Chyuan-Shen Lee	Washington State Department of Transportation
Karin Frinell-Hanrahan	Grays Harbor Department of Emergency
Dave Nelson	Washington State Emergency Management Division
Tim Walsh	Washington State Department of Natural Resources
Tony Qamar	University of Washington
George Crawford	Washington State Emergency Management Division
Marc Eberhard	University of Washington

Information and Technology Subcommittee

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William Brugger	AT&T Wireless
William Steele	University of Washington - Earth and Space Sciences
Steve Malone	University of Washington
Steve Bailey	Pierce County Department of Emergency Management
Roger Serra	Snohomish County Department of Emergency Management
Ken Parrish	Washington State Emergency Management Division
Bill Wilkinson	Port of Seattle
David Spicer	Army Corps of Engineers
David Nelson	Washington State Emergency Management Division
David Byrnes	Spokane County
Scott Mah	University of Washington, ESS
Harold Mofjeld	National Oceanic & Atmospheric Administration
Jerry Weigel	Washington State Department of Transportation
Robert Craggan	AT&T Wireless Services
Henry E. (Ted) Buehner	National Weather Service

Glenn Farley	King 5
Claudia Ellsworth	Pierce County Department of Emergency Management
Brad Butler	Qwest
Ed Henley	Washington State Department of Transportation
Richard Moczygemba	ATTWS
Jim French	Washington State Emergency Management Division
Ralph Haugerud	US Geological Survey